

Apple 1 USB Board October 15, 2015

The Apple 1 USB Board uses a part called “Easy Input” that was available from Radovan Robotics based on a Cypress one chip micro that takes Serial or Parallel data input and puts the data out on a USB port that looks to the computer like a keyboard. Radovan Robotics is no longer an active company. This board uses a mod to the Apple 1 where the VMA line short to +5 is replaced by a resistor so the VMA can be become active (see Appendix A). Using this modification the 6820 can be disabled on a cycle by cycle basis by pulling down the VMA line and the USB board function can be enabled in its place. The board has no on board firmware and no additional software is needed for the boards operation. The board is compatible with all Apple 1 software. The Radovan part came in a 24 Pin DIP configuration and an SOIC. The board layout supports either part as seen in Figure 1.

I was able to get a limited supply of the “Easy Input” parts, a few in DIP and more in SOIC packages.

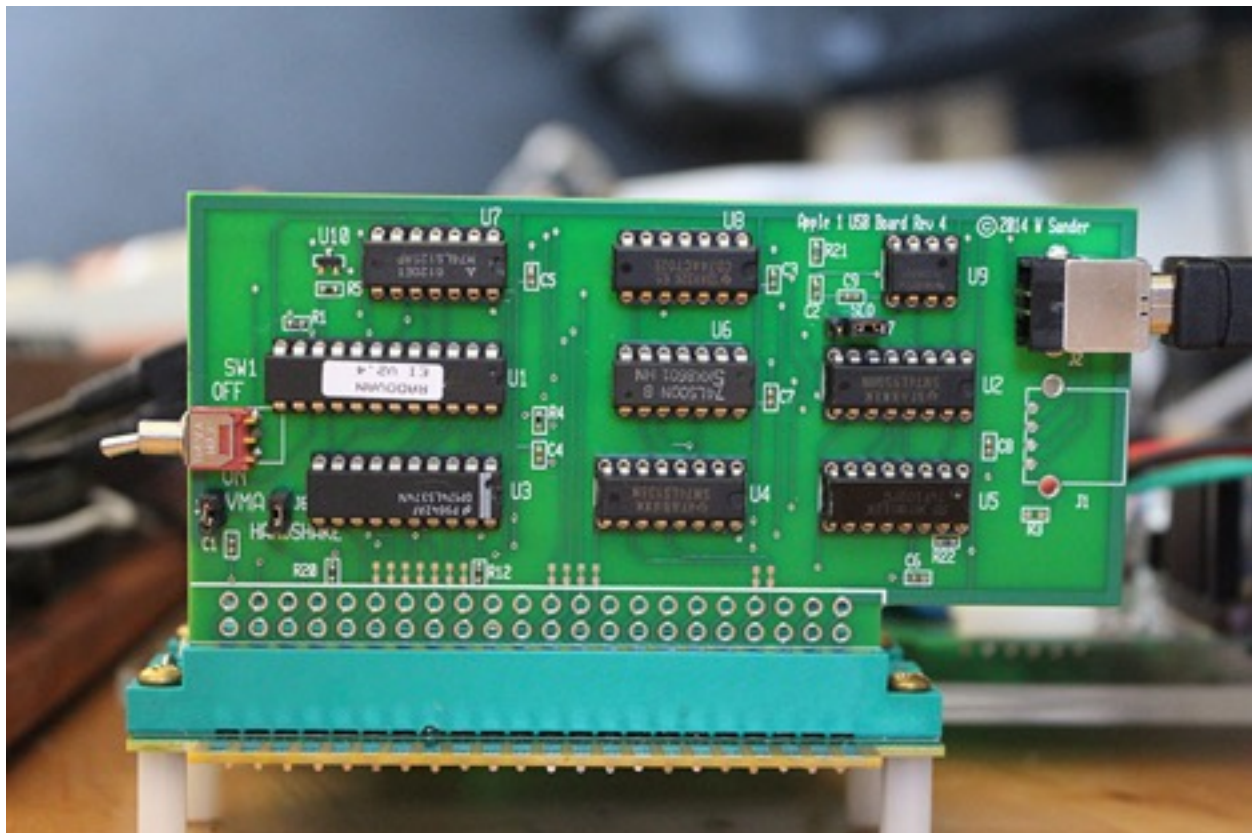


Figure 1

Table 1 shows the full address mapping for the board, Table 2 shows the mapping of the Apple 1 6820 addresses and Table 3 shows the actions of the USB board for various conditions. As can be seen if the VMA mod has been made the USB board can substitute for the Apple 1 video display routing the character stream to the USB output which looks like a USB keyboard to a Mac or PC.

USB Board Description

Full Binary Address x = "don't care"	Suggested Address to Use
1101 xxxx xxxx xx10	\$D012

Table 1 USB Board Active Address

Address	Write	Read
\$D00X	6820 Inactive	
\$D010		KBD Data Register
\$D011		KBD Control Register Bit 7=1 Ready
\$D012	DSP Data Register	DSP Status Register Bit 7= 0 Ready
\$D013	DSP Control Register	

Table 2 Apple 1 I/O Address Mapping

Switch Status	USB	Address	Write		Read	
			Register	VMA	Register	VMA
Don't Care	Don't Care	\$D010	X	Open	X	Open
Don't Care	Don't Care	\$D011	X	Open	X	Open
TEST	Don't Care	\$D012	Date Register	Low	Bit 7 Low If Ready	Low
OFF	Don't Care	X	X	Open	X	Open
ON	ON	\$D012	Date Register	Open	Bit 7 Low If Ready	Low

Table 3 USB Board Address Mapping

USB Board Description

The VMA pull down and USB Board register Read can be deactivated by jumpers on the board labelled VMA and HANDSHAKE. When these are removed the USB board will function "open loop" (no handshake) even if the VMA mod has not been done. Since the USB board is a little faster than the Apple 1 display the Apple 1 display and USB output will both happen. Occasionally the USB board may miss a character in this mode, usually at the beginning or end of a character stream.

The application note for the Radovan Easy Input device states that the Cypress chip should be powered from the USB power, however that can cause a problem. The chip is subject to "back powering" which means that if the chip is powered down inputs to the chip that are at 1 levels can power the chip through the protection diodes on those inputs. With CMOS parts the power supply can be pulled to over 4 volts, effectively powering the chip. To avoid this problem a power on reset chip U10 is used to detect the presence of USB power and tri-state the inputs if there is no USB power. This signal is also used to activate the USB Board when the toggle switch is ON and there is USB power.

Sometimes the output of the board can overrun the device to which it is connected. A 555 timer U9 can be used to optionally slow down the rate. This function is activated but the position of the shorting bar on J7. The rate is set to about 10 Characters per second but can be changed by changing R21 and/or C2.

If a generic keyboard is plugged in to the Mac, the user is asked to press the keys next to the shift keys for detection of the type of keyboard. If there is a problem with getting the board identified then this identification sequence can be found in the Keyboard section of the System Preferences when the board is connected to the computer. If the keyboard type is asked for it is ANSI. More information on this is in the Board Test Section.

USB Board Testing

For testing the USB Board the Apple 1 or Clone must have the VMA mod performed meaning that the short on the Apple 1 labeled "6502" near the 3 3K resistors and near pin 1 of the 40 pin socket at A7 should be removed and replaced by a 100pf Capacitor and 2200Ω resistor across the terminals with surface mount parts or between pins 5 and 8 of the 6502 at location A7 or pins 12 and 14 of the DIP at location B1. The USB board should be configured as shown in Figure 3 and plugged onto the PC board connector of the Apple 1 or can be plugged into an expansion slot of a known good Expansion Board configured as shown in Figure 2.

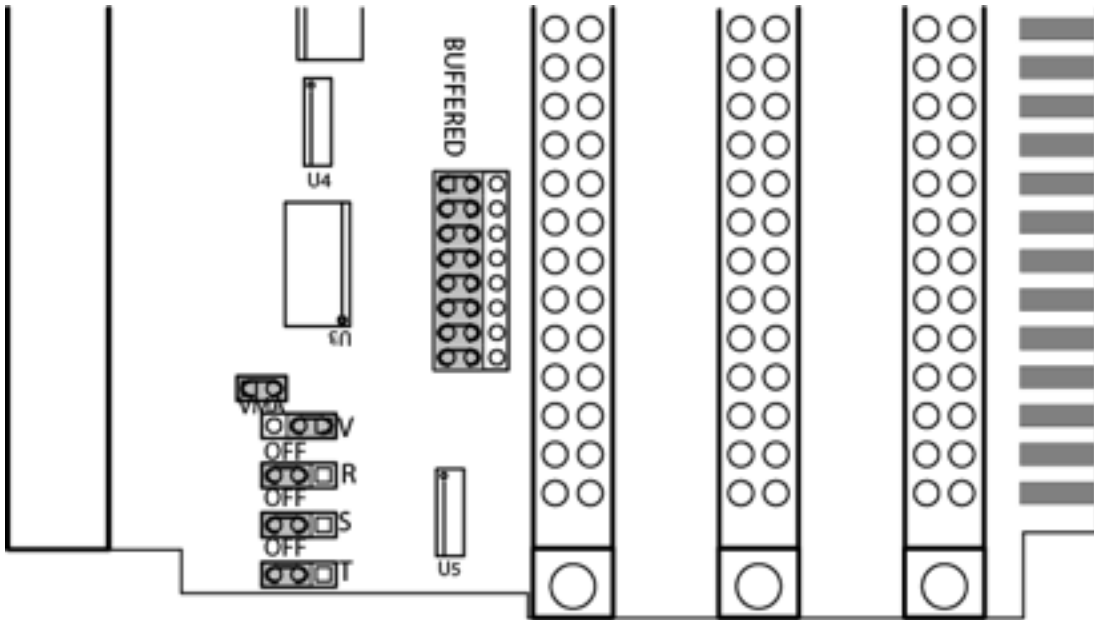


Figure 2

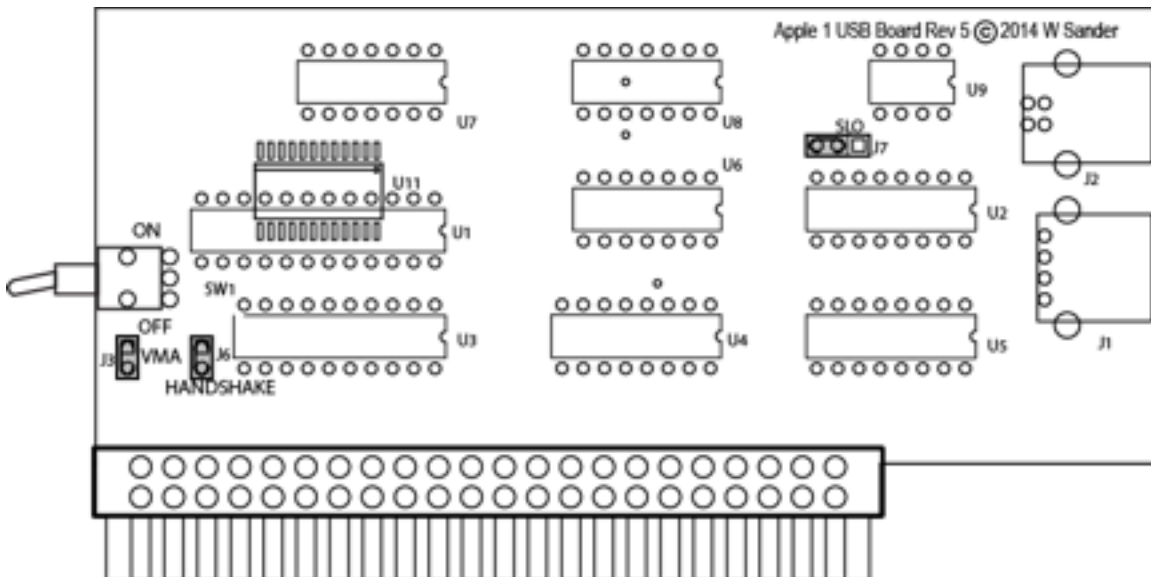


Figure 3

Power on the Apple 1 and verify that the system will reset and that the Keyboard and Display work normally. Switch the toggle switch on the USB Board to ON, the Apple 1 Display will still work normally until the USB cable is connected to the computer.

USB Board Testing

Connect the USB Board to a Mac computer with a USB Cable. The first time a working USB board is connected to a Mac the Mac will go through the Keyboard Setup sequence of Figures 4 through 8. If the sequence is successfully completed then the Mac will not request go through the sequence again. If the Mac has already had a USB board activated then to test a new USB board go to System Preferences/Keyboard and you will see either the screen of Figure 8 or Figure 9. If the screen of Figure 9 without the “Change Keyboard Type...” option then the USB connection to the USB Board is not working properly. If the “Change Keyboard Type...” option is available then choosing the option will enter the sequence of Figures 3 through 8. Note that the “Change Keyboard Type...” option will appear even if the Apple 1 is not powered because the USB chip on the USB Board is powered from the USB cable. Once the USB Board completes the sequence all keystrokes can be tested.

The TextEdit document “Apple 1 Screen” is formatted to provide an Apple 1 display and can be used with the USB Board. Move the cursor to the end of the file before use. It is best to use a copy of the file particularly if you want to keep the session. The TextEdit application autosaves. The document uses the PrintChar21 character set that can be found at

<http://www.kreativekorp.com/software/fonts/apple2.shtml>

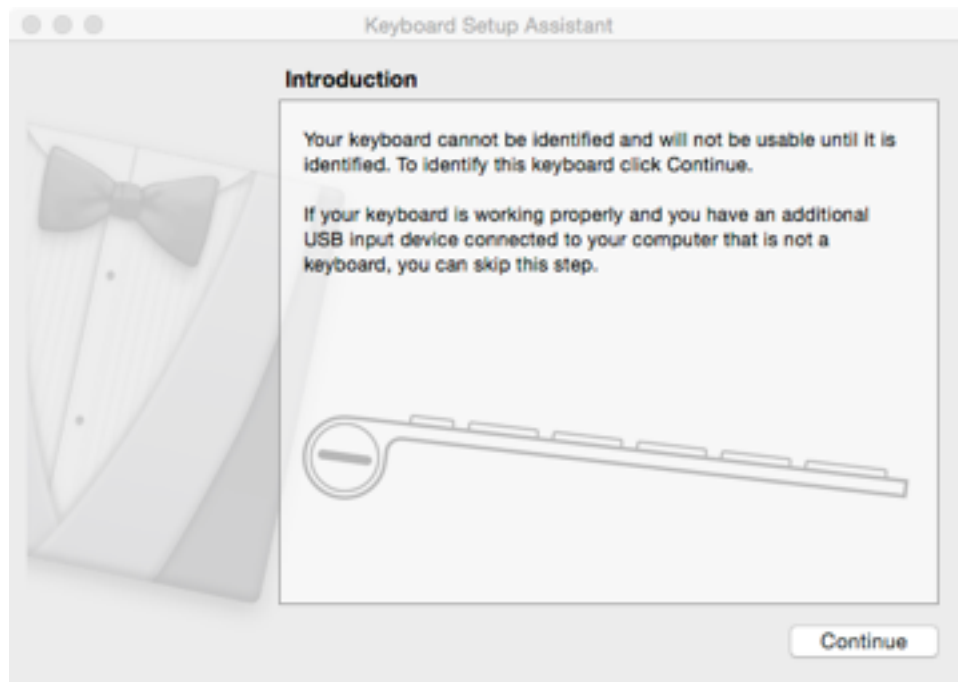


Figure 4

USB Board Testing

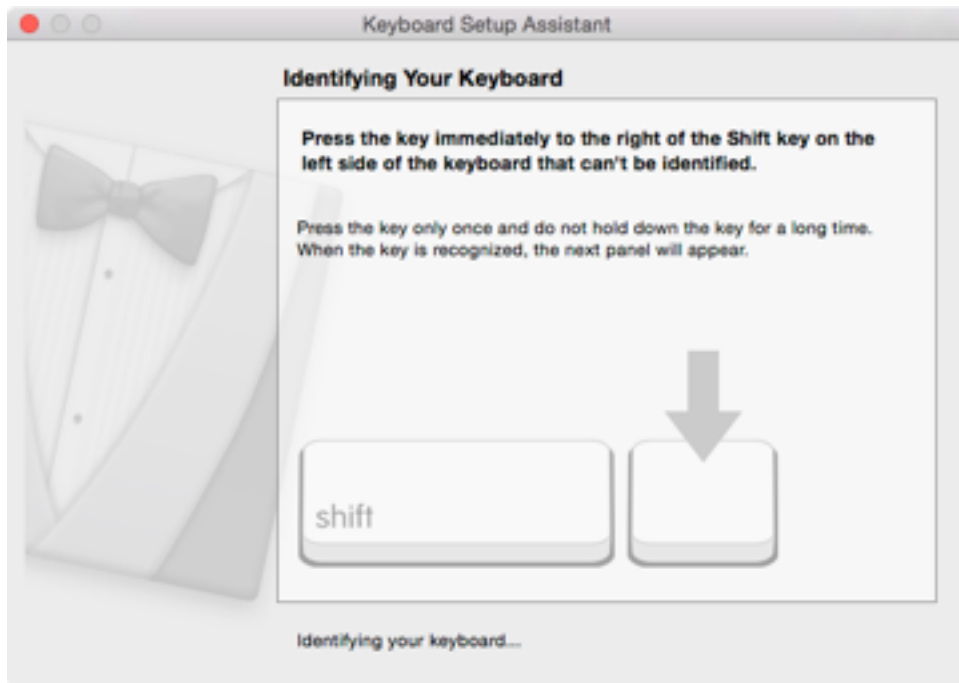


Figure 5



Figure 6

USB Board Testing

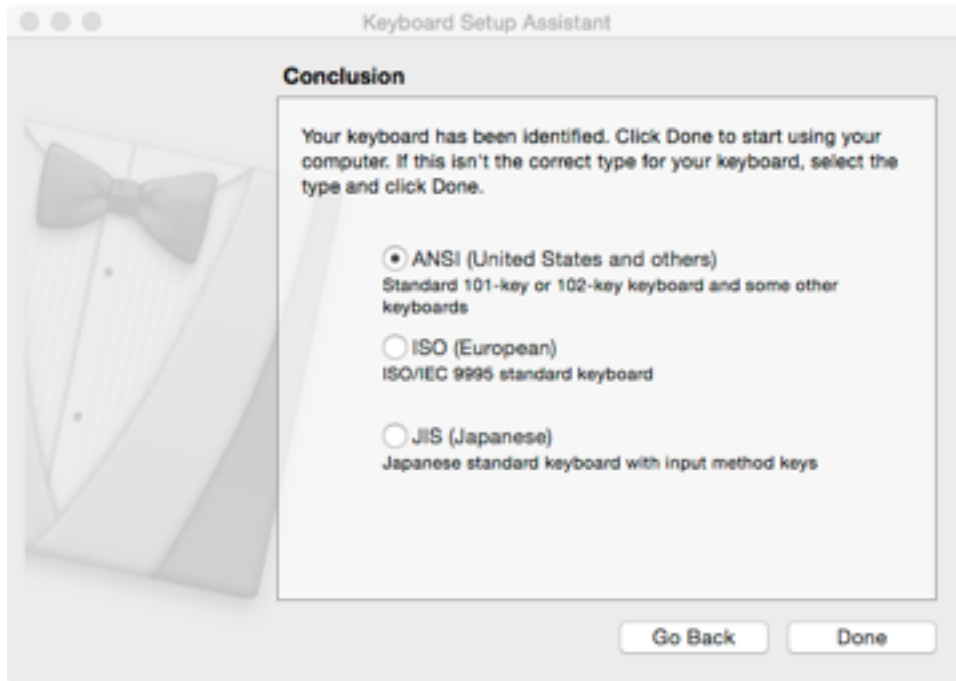


Figure 7

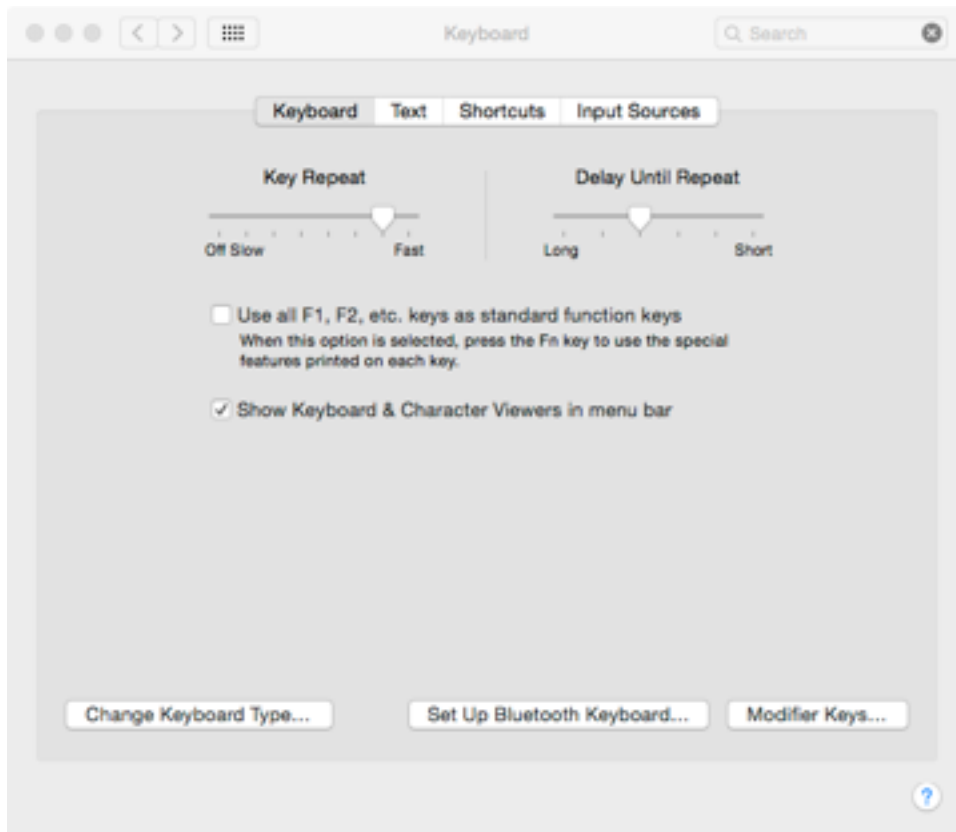


Figure 8

USB Board Testing

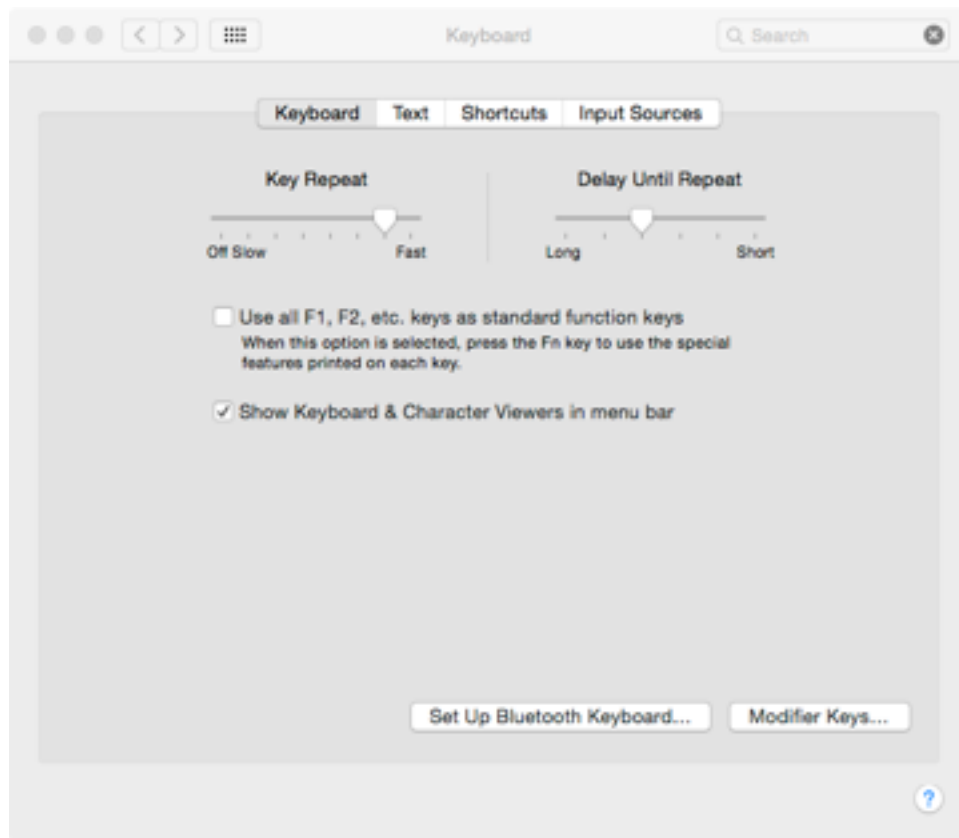
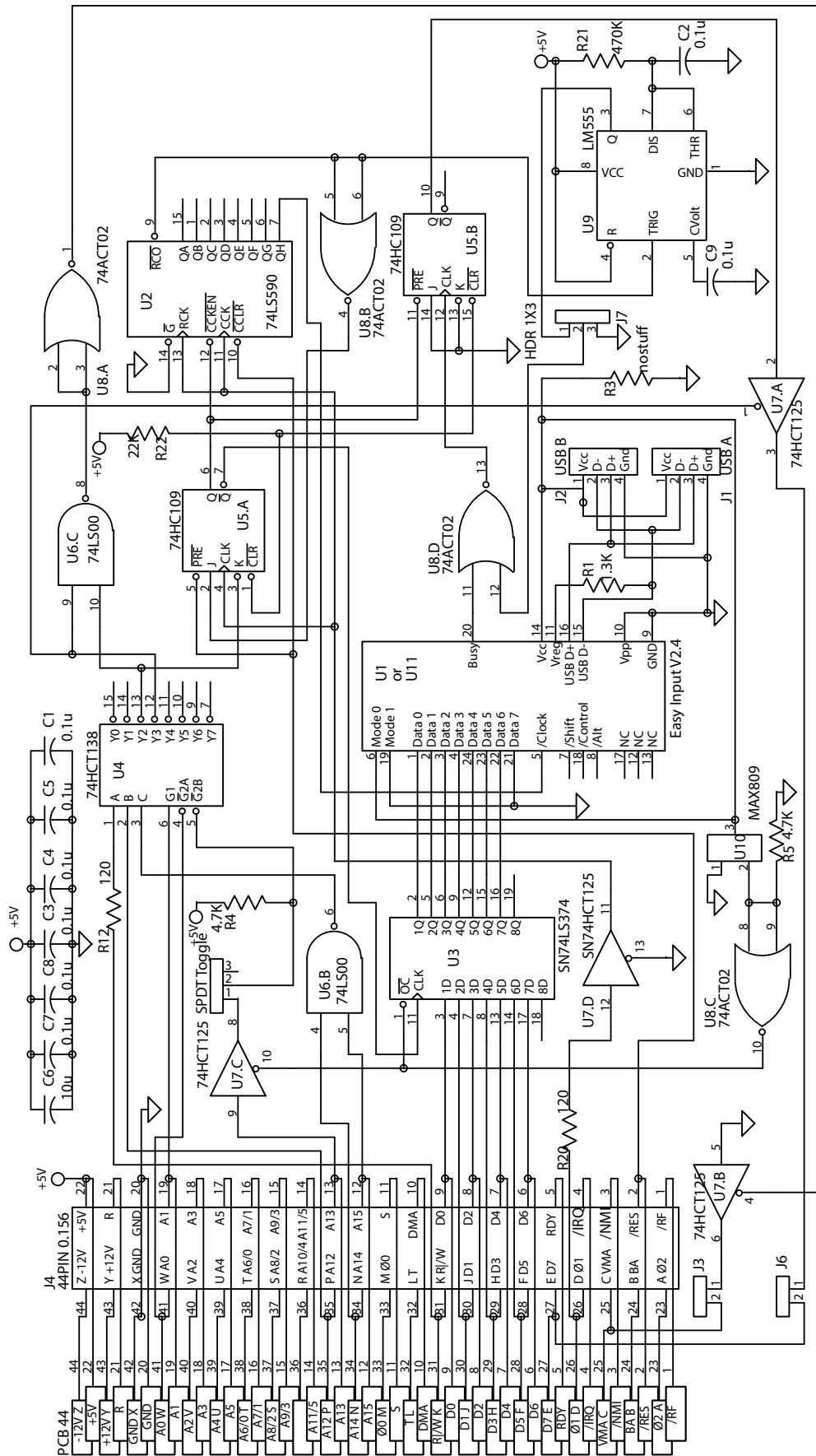
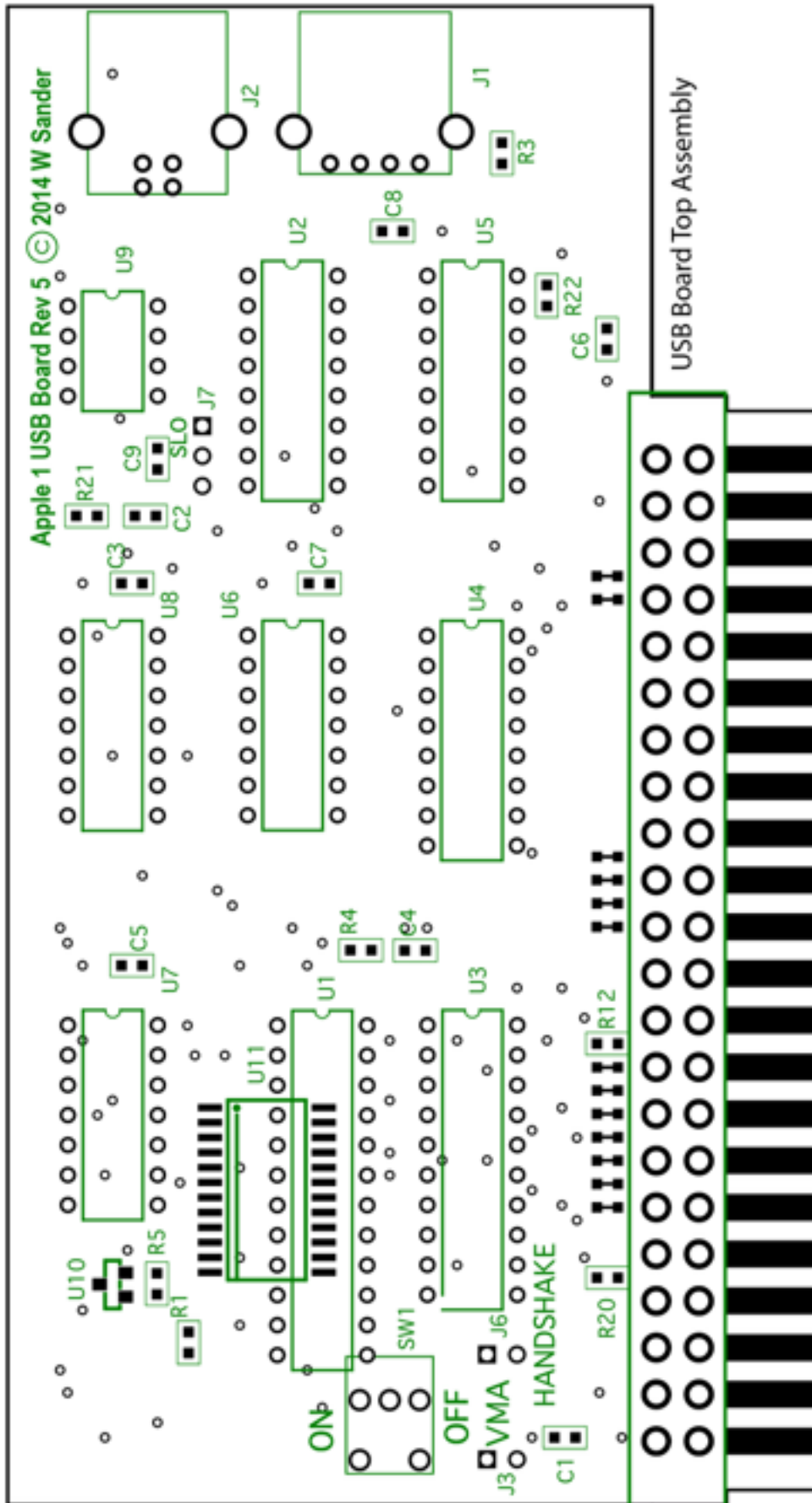
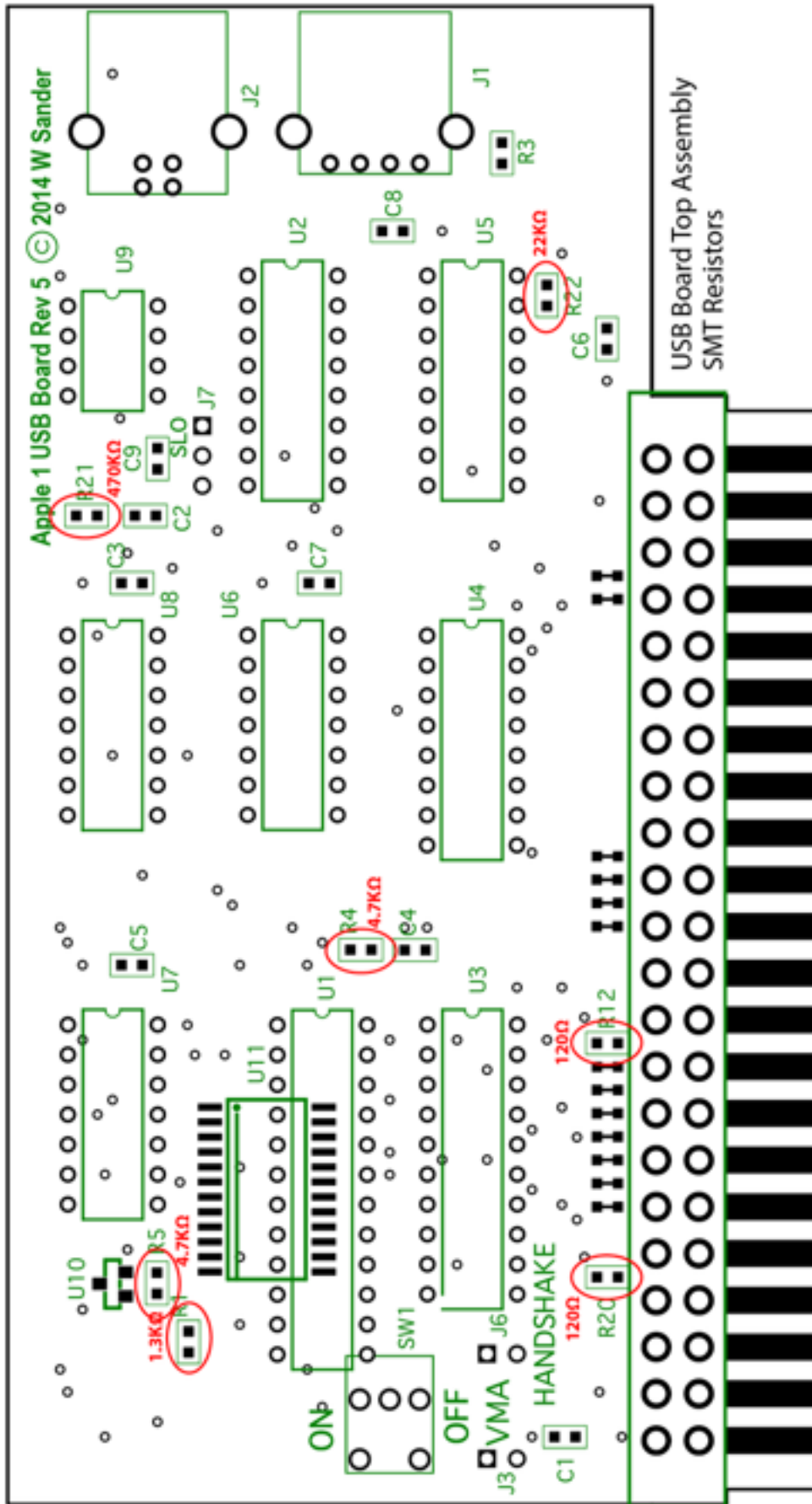


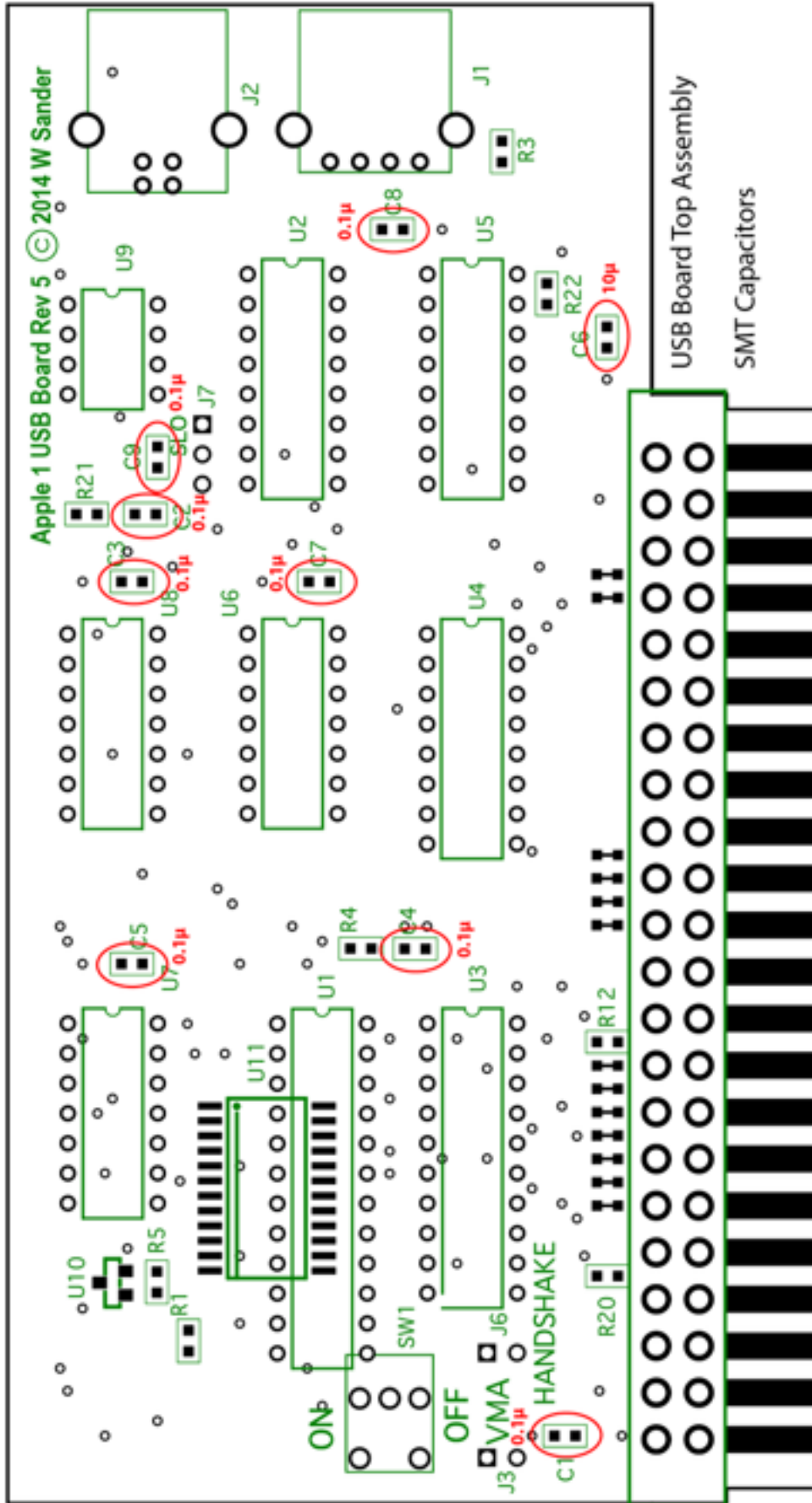
Figure 9



USB Board Rev 5 Schematic







Auxiliary Documents

USB Rev 5 Parts List

Designator	Part	Value	Manufacturer	Mfg Part No.	Description
C1	CAPACITOR	0.1u			0603 CAPACITOR
C2	CAPACITOR	0.1u			0603 CAPACITOR
C3	CAPACITOR	0.1u			0603 CAPACITOR
C4	CAPACITOR	0.1u			0603 CAPACITOR
C5	CAPACITOR	0.1u			0603 CAPACITOR
C6	CAPACITOR	10u			0603 CAPACITOR
C7	CAPACITOR	0.1u			0603 CAPACITOR
C8	CAPACITOR	0.1u			0603 CAPACITOR
C9	CAPACITOR	0.1u			0603 CAPACITOR
J1	USB A		TE Connectivity	292303-1	USB Type A Connector
J2	USB B		TE Connectivity	292304-1	USB Type B Connector
J3	HEADER	1X2	SAMTEC	TSW-102-07-L-S	1X2 0.1 In Header
J4	Card Connector	44 PIN 0.156	EDAC	305-044-520-202	44-Pin .156 Connector
J6	HEADER	1X2	SAMTEC	TSW-102-07-L-S	1X2 0.1 In Header
J7	HEADER	1X3	SAMTEC	TSW-103-07-L-S	1X3 0.1 In Header
R1	RESISTOR	1.3K Ω			0603 RESISTOR
R3	RESISTOR	nostuff			0603 RESISTOR
R4	RESISTOR	4.7K Ω			0603 RESISTOR
R5	RESISTOR	4.7K Ω			0603 RESISTOR
R12	RESISTOR	120 Ω			0603 RESISTOR
R20	RESISTOR	120 Ω			0603 RESISTOR
R21	RESISTOR	470K Ω			0603 RESISTOR
R22	RESISTOR	22K Ω			0603 RESISTOR
SW1	SPDT Toggle		C&K	T101MH9ABE	SBDT TOGGLE 2 POS
U1	Easy Input V2.4		Radovan Robotics	Easy Input V2.4	24 PIN 0.3 DIP
U2	74LS590			74LS590	16 PIN DIP
U3	74LS374			74LS374	20 PIN DIP
U4	74LS138			74LHCT138	16 PIN DIP
U5	74F109			74HC109	16 PIN DIP
U6	74LS00			74LS00	14 PIN DIP
U7	74LS125A			74HCT125	14 PIN DIP
U8	74ACT02			74LS04	14 PIN DIP
U9	555 Timer		TI	TLC555CP	8 PIN DIP
U10	MAX809	4.38V	ON SEMI	MAX809MTRG	SOT23
U11 (alt to U1)	Easy Input V2.4		Radovan Robotics	Easy Input V2.4	24 PIN SOIC